In the claims:

1. (Currently Amended) A current sensor comprising:

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having ~~two ends~~ a first end, a second end, and one or more turns, the coil being deployed around a conductor which is carrying an electric current to be sensed;

c) ~~two transformers~~ a first transformer of polarized light and a second transformer of polarized light for transforming light between linearly polarized and circularly polarized states, said transformers each comprising a birefringent fiber having ~~two ends~~ a first end, a second end, and a central axis, ~~which fiber is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber~~ the birefringent fiber comprising a twist through an angle about the central axis, said twist being at a distance from the first end of the birefringent fiber, the angle and distance ~~so~~ chosen so that linearly polarized light entering ~~a~~ said second end of the birefringent fiber exits the first end of the birefringent fiber effectively circularly polarized, the first end of ~~which~~ said first transformer ~~is~~ being coupled to the first end of the coil of single-mode fiber, and the first end of ~~which~~ said second transformer ~~is~~ being coupled to the second end of the coil;

d) a first directional coupler for optically coupling the linearly polarized light from the source to the second ends of the transformers;

e) an optical detector for receiving the light beams which have traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current; and

f) a second directional coupler for optically coupling to the optical detector ~~the~~ light ~~beams~~ which ~~have~~ has emerged from the coil, passed through the polarization transformers, and been rejoined by the first directional coupler ~~to the optical detector~~.

2. (Original) The current sensor of claim 1, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

3. (Original) The current sensor of claim 2, wherein the angle is approximately equal to $\pi/4$ radians.

4. (Original) The current sensor of claim 2, wherein the distance is approximately one quarter of a beatlength.

5. (Original) The current sensor of claim 4, wherein the angle is approximately equal to $\pi/4$ radians.

6. (Original) A current sensor as in claim 1 wherein the source of linearly polarized light is a diode laser.

7. (Currently Amended) A current sensor comprising:

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having ~~two ends~~ a first end, a second end, and one or more turns, the coil being deployed around a conductor which is carrying an electric current to be sensed;

c) ~~two transformers~~ a first transformer of polarized light and a second transformer of polarized light for transforming light between linearly polarized and circularly polarized states, said transformers each comprising a birefringent fiber having ~~two ends~~ a first end, a second end, and a central axis, ~~which fiber is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber~~ the birefringent fiber comprising a twist through an angle about the central axis, said twist being at a distance from the first end of the birefringent fiber, the angle and distance ~~so~~ chosen so that linearly polarized light entering ~~a~~ the second end of the birefringent fiber exits the first end of the birefringent fiber circularly polarized, the first end of ~~which~~ the first transformer ~~is~~ being coupled to the first end of the coil of single-mode fiber, and the first end of ~~which~~ the second transformer ~~is~~ being coupled to the second end of the coil;

d) a first directional coupler for optically coupling the linearly polarized light from the source to the second ends of the transformers; and

e) an optical detector for receiving ~~the~~ light ~~beams~~ which ~~have~~ has traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current, ~~which~~ wherein the optical detector is deployed at ~~the~~ a rear facet of the source.

8. (Original) The current sensor of claim 7, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

9. (Original) The current sensor of claim 8, wherein the angle is approximately equal to $\pi/4$ radians.

10. (Original) The current sensor of claim 8, wherein the distance is approximately one quarter of a beatlength.

11. (Original) The current sensor of claim 10, wherein the angle is approximately equal to $\pi/4$ radians.

12. (Original) A current sensor as in claim 7 wherein the source of linearly polarized light is a diode laser.

13. (Currently Amended) A current sensor comprising:

a) a source of linearly polarized light;

b) a coil of single-mode optical fiber having ~~two ends~~ a first end, a second end, and one or more turns, the coil being deployed around a conductor which is carrying an electric current to be sensed;

c) a transformer of polarized light for transforming light between linearly polarized and circularly polarized states, said transformer comprising a birefringent fiber having a first end, a second end, and a central axis, ~~which fiber is twisted through and angle about a central axis running therethrough at an appropriate distance from a first end of the fiber~~ the birefringent fiber comprising a twist through an angle about the central axis, said twist being at a distance from the first end of the birefringent fiber, the angle and distance ~~so~~ chosen so that linearly polarized light

entering ~~a~~ the second end of the birefringent fiber exits the first end of the birefringent fiber circularly polarized, the first end of ~~which~~ the first transformer ~~is~~ being coupled to the first end of the coil of single-mode fiber, and the first end of ~~which~~ the second transformer ~~is~~ being coupled to the second end of the coil;

d) a reflector connected to ~~a~~ the second end of the coil; and

e) an optical detector for receiving ~~the~~ light ~~beams~~ which ~~have~~ has traversed the coil and producing an output signal indicative of a magnetic field produced by the electric current.

14. (Original) The current sensor of claim 13, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

15. (Original) The current sensor of claim 14, wherein the angle is approximately equal to $\pi/4$ radians.

16. (Original) The current sensor of claim 14, wherein the distance is approximately one quarter of a beatlength.

17. (Original) The current sensor of claim 16, wherein the angle is approximately equal to $\pi/4$ radians.

18. (Original) A current sensor as in claim 13 wherein the source of linearly polarized light is a diode laser.

19. (Currently Amended) A method of detecting the a current in a conductor comprising:

a) generating a linearly polarized light beam;

b) dividing the linearly polarized light beam ~~in a directional coupler~~ into ~~two beams~~ a first beam and a second beam, using a directional coupler, the first beam having a polarization and the second beam having a polarization, the polarization of the first beam and the polarization of the second beam being linear;

c) transforming the ~~two linearly polarized light beams into circularly polarized light, beams, using polarization transformers~~ polarization of the first beam from effectively linear to effectively circular using a first transformer of polarized light, and transforming the polarization of the second beam from effectively linear to effectively circular using a second transformer of polarized light, said transformers each comprising a birefringent fiber having ~~two ends~~ a first end, a second end, and a central axis, ~~which is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber~~ the birefringent fiber comprising a twist through an angle about the central axis, said twist being at a distance from the first end of the birefringent fiber, the angle and distance ~~so~~ chosen so that a linearly polarized light beam entering ~~a~~ the second end of the birefringent fiber exits the first end of the birefringent fiber effectively circularly polarized, the transformers ~~arrayed~~ oriented so ~~while the beam emerging from the first end of one the first transformer~~ that when the polarization of the first beam is transformed to effectively circular polarization in a clockwise direction, ~~that emerging from the first end of the other second transformer~~ the polarization of the second beam is ~~polarized~~ transformed to effectively circular polarization in a counter-clockwise direction;

d) coupling the ~~two circularly polarized beams~~ first beam into ~~opposite ends~~ a first end of a coil of single-mode optical fiber, and coupling the second beam into a second end of the coil, the coil having one or more turns, ~~which~~ said coil ~~being~~ disposed around a conductor of electric current;

e) permitting the beams to pass through the coil in opposite directions;

f) transforming the ~~circularly polarized beams back into linearly polarized beams~~ polarization of the first beam from effectively circular to effectively linear, and transforming the polarization of the second beam from effectively circular to effectively linear, by means of the polarization transformers;

g) combining the ~~two linearly polarized beams~~ first beam and the second beam into a combined beam by means of the directional coupler;

h) passing the combined beam through a linear polarizer; and

i) receiving said combined beam with an optical detector for producing an output signal indicative of a magnetic field produced by the electric in the conductor.

20. (Original) The method of claim 19, wherein the angle is approximately equal to an odd multiple of π/4 radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

21. (Original) The method of claim 20, wherein the angle is approximately equal to π/4 radians. The method of claim 20, wherein the distance is approximately one quarter of a beatlength.

22. (Original) The method of claim 20, wherein the distance is approximately one quarter of a beatlength.

23. (Original) The current sensor of claim 22, wherein the angle is approximately equal to π/4 radians.

24. (Original) The method of claim 19 wherein the source of linearly polarized light is a diode laser.

25. (Currently Amended) A method of detecting ~~the~~ a current in a conductor comprising:

a) generating a linearly polarized light beam ;

b) transforming the ~~polarized light beam into circularly polarized light beams~~ polarization of the light beam from linear to circular using a polarization transformer, said transformer including a birefringent fiber having a first end, a second end, and a central axis, ~~which is twisted through an angle about a central axis running therethrough at an appropriate distance from a first end of the fiber~~ the birefringent fiber comprising a twist through an angle about the central axis, said twist being at a distance from the first end of the birefringent fiber, the angle and distance ~~so~~ chosen so that ~~a~~ an effectively linearly polarized light beam entering ~~a~~ the second end of the birefringent fiber exits the first end of the birefringent fiber circularly polarized;

c) coupling the beam into ~~an~~ a first end of a coil of single-mode optical fiber having one or more turns, ~~which coil~~ and being disposed around a conductor of electric current;

d) permitting the beam to pass through the coil;

e) reflecting the beam at ~~the~~ a second end of the coil so that it passes through the coil a second time in the opposite direction;

f) transforming the beam back into a linearly polarized beam polarization of the light beam from effectively circular to effectively linear, by means of the polarization transformer;

g) passing the beam through a linear polarizer; and

i) receiving said beam with an optical detector for producing an output signal indicative of a magnetic field produced by the electric in the conductor.

26. (Original) The method of claim 25, wherein the angle is approximately equal to an odd multiple of $\pi/4$ radians, and the distance is approximately an odd multiple of one quarter of a beatlength.

27. (Original) The method of claim 26, wherein the angle is approximately equal to $\pi/4$ radians.

28. (Original) The method of claim 26, wherein the distance is approximately one quarter of a beatlength.

29. (Original) The current sensor of claim 28, wherein the angle is approximately equal to $\pi/4$ radians.

30. (Original) The method of claim 25 wherein the source of linearly polarized light is a diode laser.

31. (New) The current sensor of claim 1, wherein said twist is created by applying a local heat source and applying torsion to the birefringent fiber.

32. (New) The current sensor of claim 1, wherein said birefringent fiber comprises a core diffused into a cladding.